

FIRST RECORD OF THE AUSTRAL SPECIES *PLOCAMIMUM SECUNDATUM* (GIGARTINALES, RHODOPHYTA) FROM THE MEDITERREAN SEA

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ABSTRACT - The occurrence in the Mediterrean Sea of an austral species of *Plocamium*, *P. secundatum* (Kützinger) Kützinger, is reported. Mediterrean specimens show slight differences, as to Kützinger's description and iconography, regarding the number of unilaterally arranged ramuli and stichidium features.

RÉSUMÉ - Les Auteurs signalent la présence en Méditerranée d'une espèce australe de *Plocamium*: *P. secundatum* (Kützinger) Kützinger. Les exemplaires méditerranéens diffèrent légèrement de la description et de l'iconographie de Kützinger, soit par le nombre des ramules unilatéraux, soit par la morphologie de leurs stichidies.

KEY WORDS : *Plocamium secundatum*, Mediterranean Sea, geographic distribution.

INTRODUCTION

The genus *Plocamium* Lamouroux embraces some 35 species prevalently distributed in the southern hemisphere (Tab. I).

Most of them are endemic or show a restricted distribution area. Only *P. cartilagineum* (L.) Dixon has a cosmopolitan distribution and it is just this species the only up to now recorded from the Mediterrean Sea (Gallardo *et al.*, 1985; Ballesteros, 1990; Boudouresque, 1984; Perret-Boudouresque & Seridi, 1989; Furnari, 1984; Giaccone *et al.*, 1985; Ben Maiz *et al.*, 1987; Athanasiadis, 1987).

In the present account the occurrence in the Mediterrean Sea of another species of *Plocamium*, *P. secundatum* (Kützinger) Kützinger, is reported. This species up to now was reported only from Cape Horn (Kützinger, 1849), Antarctica (Skottsberg, 1952), South Argentina (Kühnemann, 1969), Chile and Sub-antarctic Islands (Levring, 1960), Macquarie Island (Ricker, 1987).

MATERIALS AND METHODS

Both sterile and tetrasporic thalli were hand collected using SCUBA at Ognina (Catania, Italy) (Fig. 1) at 25 m depth in a community with *Cystoseira spinosa* Sauvageau.

All the observations were made on fluid preserved material. Herbarium specimens are held at the Botanical Institute of University of Catania.

The following material has also been studied: *Plocamium secundatum* (Kützting) Kützting, type material from Hermite Is. (Cape Horn), Rijksherbarium L 9140 n.1.

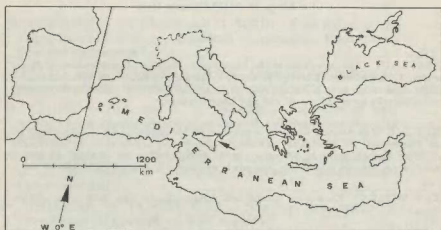


Fig. 1 - Map showing the locality of collection (arrow) of *Plocamium secundatum* (Kützting) Kützting in the Mediterranean Sea.

OBSERVATIONS

Thalli erect, to 4 cm high, irregularly ramified, with flattened main axes to 250 μm broad. Four-six ramuli in alternating series up to median parts of the axes, ten-fifteen unilaterally arranged in the apical parts, up to thirty-fourty in some specimens (Fig. 2) which show axes and ramuli incurved (Fig. 3). The lowermost ramuli are generally simple, while the others are alternately ramified near the base, unilaterally near the apex.

Stichidia are simple (Fig. 4) or branched 2-3 times (Fig. 5). The shortest straight, the longest, up to 450-480 μm long and 60-75 μm diameter, curved (Fig. 6). Tetrasporangia, zonately divided, are arranged in two rows. Spermatangia and cystocarps not observed.

DISCUSSION

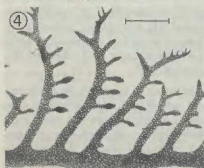
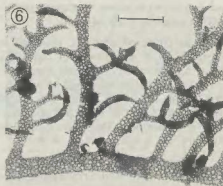
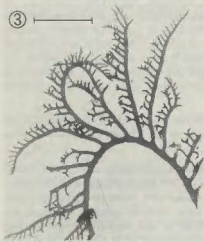
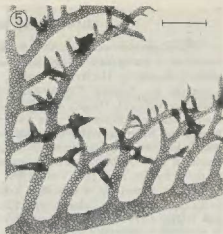
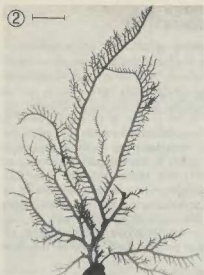
P. secundatum was described by Kützing (1849: 883) as a variety of *P. coccineum* Kützing (now *P. cartilagineum*). He based his description on specimens collected by Hooker at Hermite Island, N.W. Bay, near Cap Horn. Later, in his *Tabulae Phycologicae*, he treated this taxon as a species (Kützing 1866: vol. 16: tab. 42 c, d). According to Kützing's description, the main distinctive character of the species is the unilateral branching of both ramuli and their secondary branches. In our opinion, however, the predominantly unilateral arrangement of ramuli along axes is quite a distinctive character too. Although not mentioned either in the original description or in those by De Toni (De Toni, 1900: 591) and Mazza (Mazza, 1916-1922: 1543), it is illustrated in Kützing's iconography where a unilateral series up to 13 ramuli is drawn. Mazza (*op. cit.*) in specimens from Magellan Straits and Ricker's (1987) in specimens from Macquarie Island observed only up to 6 ramuli unilaterally arranged, while in the Mediterranean specimens 10-15 (up to 40 in some specimens showing a peculiar habit) can be observed in the terminal parts of axes.

As concerns stichidia, they are described as "suarroso-ramellosis vel dentatis" and illustrated as both oppositely and star-wise branched by Kützing (*op. cit.*); oppositely branched, by Ricker (*op. cit.*); cruciately, fan-wise and star-wise branched as well as individual, long and slightly hooked, by Mazza (*op. cit.*). In the type specimen, however, simple as well as 1-2 times not oppositely branched stichidia are present too. In our specimens, as above mentioned, they are simple or branched 2-3 times, the shortest straight, the longest curved.

Moreover, some size variability is shown too; 6 cm in Kützing's; 4 cm in Mazza's and Mediterranean specimens; up to 13 cm in Ricker's specimens.

Both branching pattern and stichidium morphology are considered as very important features in the taxonomy of the genus *Plocamium* (Womersley, 1971; South & Adams, 1979). In *P. secundatum*, however, branching pattern, being consistent in all thalli up to now studied, appears the most significant character. The same cannot be said of the stichidium morphology that is rather various. The variability of this character is also reported from other species as *P. angustum* (J. Ag.) Hook. et Harv. and *P. cartilagineum* (South & Adams, *op. cit.*) from New Zealand. On this subject, it is interesting to record the occurrence of a new type of stichidial morphology (long and curved) observed in both old herbarium and recently field collected specimens of *P. cartilagineum* (Fig. 7) from Eastern Sicily.

Our specimens differ from *P. secundatum* only in inconsistent characters as the number of unilaterally arranged ramuli and the stichidium morphology (although in the type specimen some stichidia show the same morphology of ours) while they show the same habit and branching pattern. Therefore, we can conclude that they well fit to that species. As well, also Mazza's and Ricker's specimens well fit to *P. secundatum*, differing from Kützing's type only in inconsistent characters as: size, number of unilaterally arranged ramuli, stichidium morphology.



Finally, the occurrence of *P. secundatum* in the Mediterranean Sea raises interesting biogeographic questions. In fact, it is surprising that the first finding in the Northern hemisphere of an austral species of cold affinity occurs in the Mediterranean that, according to Lüning (1990), is a warm temperate sea. But, due to its spot distribution in that Sea, it seems too early to put forward any hypotheses on the causes of this disjunct distribution. Undoubtedly, the above mentioned differences between austral and mediterranean specimens (number of unilaterally arranged ramuli; stichidial features), even if light, could let suppose an acclimatation process of a taxon which has been living in the Mediterranean Sea for a long time. On the other hand, the noticeable polymorphism of the species of the genus *Plocamium*, in addition to the above mentioned spot distribution, should be in accordance with a recent introduction of this species in the Mediterranean Sea.

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Figs 2-6: *Plocamium secundatum* (Kützinger) Kützinger. - Fig. 2: Peculiar habit of a specimen with up to 40 unilateral ramuli. - Fig. 3: Detail of a curved axis with unilateral ramuli. - Fig. 4: Detail of the thallus showing short and simple stichidia. - Fig. 5: Short and branched 2-3 times stichidia. - Fig. 6: Long and curved stichidia.

Fig. 7 - *Plocamium cartilagineum* (L.) Dixon: Detail of the thallus showing elongate, ramified and curved stichidia.
Bar = 2.5 mm (Figs 2-3); bar = 0.5 mm (Figs 4-7).

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Tab. 1 - Geographic distribution and bibliography (numbers in brackets) of the species of the genus *Plocamium* Lamouroux. Synonyms in italics. Species marked with an asterisk are of uncertain taxonomic value.

- P. angustatum* (J. Agardh) Hooker et Harvey
P. abnorme Hooker et Harvey (37)
P. angustatum Kützing (37)
P. botryooides Kützing (4)
P. dispersum Harvey (37)
P. gracile J. Agardh (37)
- P. beckeri* Simons
- P. brasiliense* (Greville) Howe et Taylor
- P. cartilagineum* (Linnaeus) Dixon
P. angustum v. *pusillum* (Sonder) Harvey (13)
P. binderianum Kützing (9)
P. brachiocarpum Kützing (37)
P. californicum Kützing (12)
P. coccineum (Hudson) Lyngbye (37)
P. coccineum f. *compactum* Collins (8)
P. coccineum v. *pacificum* (Kylin) Dawson (14)
P. coccineum v. *uacinctum* J. Agardh (34)
P. cruciferum Harvey in Farlow (37)
P. fenestratum Kützing (12)
P. irregulare Meneghini (9)
P. lyngbyanum (9)
P. mediterraneum Meneghini (9)
P. pacificum Kylin (30)
P. pusillum Sonder (41)
P. subtile Kützing (9)
P. uacinctum Kützing (9)
P. vulgare Lamouroux (37)
- P. concinnum* Areschoug
P. hiserratum Dickie (9)
- P. confervaceum* Bory*
P. coccineum v. *confervaceum* Bory (18)
- P. corallorhiza* (Turner) Harvey
P. robertiae Schmitz ex Mazza (33)
- P. cornutum* (Turner) Harvey
- P. costatum* (C. Agardh) Hooker et Harvey
P. cunninghamii (Grev.) Hooker et Harvey (37)
- P. delicatulum* Baardseth
P. dilatatum J. Agardh
P. foelichianum Kützing*
P. fuscovibrum Baardseth
P. glomeratum J. Agardh
P. affine Kützing (33)
P. subfastigiatum Kützing (33)
- P. hamatum* J. Agardh
- P. hookeri* Harvey
- S. Australia and Tasmania (41);
 N. Zealand, Chatams Is.,
 Stewart Is., Auckland Is (37);
 Fiji Is. (4);
 New Caledonia Is. (9)
- S. Africa (33)
 - North Carolina, the West Indies,
 Venezuela, Brazil (32, 42)
 - S. Australia and Tasmania (41);
 Senegal (19); from Bering Sea
 to California, Iceland and N.
 Atlantic (31); S. Africa (33);
 Faeroes Is. (15); N. Sea (16);
 Chile, S. Fernandez Is. (30);
 Kent (39); Netherlands (38);
 Norway (29); Antarctica (45).
- Cape Vert Is. (9, 26).
- Chile: Concepcion (37).
- Cape of Good Hope (9); South
 Africa (33)
 - Cape of Good Hope (9); Namibia
 (43); South Africa (33);
 Mauritius (2, 3)
 - S. Australia and Tasmania (41);
 New Zealand (37), the Philippines (36)
 - Tristan da Cunha (7).
 - S. Australia and Tasmania (41).
 - Senegambia (9); Tasmania (11).
 - Tristan da Cunha (7).
 - Cape of Good Hope (9); Namibia
 (43); South Africa (33).
- N. Zealand (37); Great Barrier
 (6); Norfolk and Cook Is. (5).
 - Kerguelen (9); South Orkney,
 South Georgia, Antarctica (27)
 Macquarie (28)

- P. leptophyllum* Kützing
P. coccineum v. *flexuosum* J. Agardh (37)
P. flexuosum (Hooker et Harvey) Sonder (41)
P. leptophyllum v. *flexuosum* J. Agardh (24)
P. leptophyllum v. *recurvatum* J. Agardh (9)
P. leptophyllum v. *strictum* J. Agardh (9)
- P. maxillosum* (Poiret) Lamouroux
P. membraceum Suhr (32)
- P. mertensii* (Greville) Harvey
P. nidificum Harvey ex J. Agardh (9)
P. procerum (J. Agardh) Hooker et Harvey (9)
- P. microcladioides* South et Adams
P. minutum Levring
P. oregonum Doty
P. avicorne Okamura
P. oviforme Okamura (24)
P. patagiatum J. Agardh
P. patens Martens
P. preissianum Sonder
P. preissii Kützing (22)
P. vuphelsianum Dangeard
P. recurvatum Okamura
P. rigidum Bory
P. condensatum Kützing (33)
P. latiusculum Kützing (33)
P. rigidum v. *tenuior* Grunow (33)
P. robustum Kützing (33)
- P. sandvicense* J. Agardh
P. secundatum (Kützing) Kützing
P. coccineum Hooker et Harvey (9)
P. coccineum v. *australe* J. Agardh (9)
P. coccineum v. *secundatum* Kützing (18)
- P. serrulatum* Okamura
P. suhrii Kützing
P. coccineum v. *latiusculum* Kützing (9)
P. fulleræ Schmitz (33)
P. nobile J. Agardh (33)
P. procerum Suhr (33)
- P. telfairiae* (Hooker et Harvey) Harvey
ex Kützing
P. abnorme f. *uncinatum* Okamura (24)
- P. violaceum* Farlow
P. tenue Kylin (31)
- S. Australia and Tasmania (41);
Japan (44); New Zealand (37).
- S. Africa (25, 33)
- S. Australia and Tasmania (41)
- New Zealand (37); East Australia;
Coffs Harbour (23)
- Crozet Is. (7).
- From North Canada to California (13).
- Japan (44).
- S. Australia and Tasmania (41).
- The Philippines (36).
- S. Australia (41).
- Portugal, Spain, Morocco (1).
- Japan (10, 44).
- Cape of Good Hope (9); Namibia
(43); South Africa (33).
- Hawaii (21).
- Magellan Straits (9); Chile,
Falkland, S. Georgia, Kerguelen
(20); S. Argentina (17); Palmer
Archipelago, W. Antarctica (35);
South Orkney, Macquarie (28).
- Japan (44); The Philippines (36,
only the v. *pectinatum* Cordero)
- S. Africa (33)
- Mauritius (2); Ghana (19);
S. Africa (33); Japan (24, 44);
Tierra del Fuego (27); China,
Korea, New Zealand, Australia,
Tasmania, Pakistan, Mauritius
(40); the Philippines (36).
- From SW. Alaska to Mexico (13,
31); Chile (30).

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